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FIRST ANNUAL REPORT
OF THE
RESEARCH DEPARTMENT
OF THE
INDIAN COFFEE BOARD

(1947-48)

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FIRST ANNUAL REPORT

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INDIAN COFFEE BOARD

RESEARCH DEPARTMENT

(1947-48)

Introductory

The Research Department of the Indian Coffee Board may be said to have come into being with a small beginning when what was then the Indian Coffee Market Expansion Board started to finance the Coffee Quality Scheme which was started in 1939 under the aegis of the Imperial Council of Agricultural Research. From that time the scope and activities of this Department have gradually expanded culminating in the transfer to the Board of the Coffee Experimental Station of the Mysore Department of Agriculture at Balehonnur, and the U. P. A. S. I. Coffee Experimental Station at Sidapur in Coorg. In the meanwhile the Woddermotte estate at Chethalli, Coorg, which has a much larger area and greater potentialities for expansion than the Sidapur Station, was purchased in 1947 for opening a sub-station representative of this important coffee tract.

2. The area comprising the two stations and the distribution of crops is furnished below :—

Main Station, Balehonnur (Mysore)			Sub-station, Chethalli (Coorg)		
		Acres			*Acres*
Coffee (Arabica other than selections)	...	82.00	Coffee (Arabica)	...	85.60
Do. (Arabica selections)	...	29.00	Do. (Robusta)	...	1.85
Do. (Robusta)	...	16.00	Orange (Coorg Mandarin)	...	27.28
Paddy (wet land)	...	1.10	Unplanted orange land	...	9.00
Orchard	...	5.00	Paddy (wet land)	...	7.21
Cardamom	...	2.00	Reserve jungle	...	69.57
Reserve jungle	...	151.00	New jungle granted by Coorg Government	...	64.74
Area occupied by :			Area occupied by :		
buildings, roads, paths, water tanks, embankments etc	...	7.48	(a) Buildings, roads, paths etc.		3.02
			(b) Water tank, abuttments etc		0.37
Total	...	293.58	Total	...	268.64

3. **Administration** :— I took charge of the Research Department of the Indian Coffee Board on 18th December 1947. Dr. N. G. Chokkanna, who joined the Coffee Board as Chemist in May 1947, took charge of the Balehonnur Station early in June and was in general charge of the research work till I took over. The Station at Chethalli was supervised by Mr. G. M. Manjanathayya, a member of the Coffee Board and its Research Committee, in an honorary capacity till I took over in December,

Mr. S. Sundaram who joined the service of the Board as Agronomist in December 1947, was placed in charge of the Chethalli Sub-Station in the same month. The Coffee Experimental Station of the U. P. A. S. I. at Sidapur (Coorg) was taken over by me in December 1947, but, it was later decided to close down this Station and transfer the work in progress there to the sub-station at Chethalli. Three subordinate officers of the Mysore Agricultural Department were drafted into the service of the Board during the period under report. Pending finalisation of the selection and appointment of additional staff, the remaining Mysore Government staff of the Balehonnur Station and the U. P. A. S. I. staff of the Sidapur Station continued to work under the Indian Coffee Board.

4. **Finance** :— A financial statement for the year ending 30th June 1948 is appended (Appendix I).

5. **Season and Crop** :

Balehonnur (Mysore) :— Weather conditions during the period under report were fairly normal. The S. W. Monsoon (1947) was somewhat late in arriving and the usual monsoon conditions set in only by the middle of July. A total of 109.25 inches of rain was received during the period against the average of 103.68 inches during the previous 10 years. Out of this total, 76.11 inches were recorded during July, August and September which, as usual, proved to be the wettest months. The North-East monsoon was comparatively a failure, the total precipitation during October, November and December amounting to 4.67 inches only. Further, January, February and March were very dry months recording only 0.41 inches. Blossom showers fell on the 1st, 2nd and 3rd April amounting to 1.27 inches, producing a good blossom. This was followed by frequent showers in April and May which gave a good set and the production of a good flush of new leaves. The 1948 monsoon set in by the 12th of June and the total rainfall in that month amounted to 15.67 inches. 30.33 inches of rainfall were recorded in July and 39.49 inches in August. This continued wet weather resulted in heavy leaf and fruit drop all over the tract. The standing crop is estimated at 10 tons.

6. **Chethalli (Coorg)** :— Following a lean season during the previous year when there was not enough interval for the wintering of coffee bushes, the 1947-48 season also proved disappointing. The blossom appeared in three instalments. The first blossom shower of 50 cents fell on the 24th January and a second of 40 cents fell on 19th February. These showers between them were responsible for prematurely bringing out about 40 per cent of the spikes ; but, due to the droughty conditions following, there was a heavy shedding. The final blossom shower fell on

the 2nd April. Here again, the dry weather following was unfavourable for normal setting. Judging from the condition of the standing crop, the forecast for the next harvest is about 12 tons. The rainfall statements of the two stations are appended (Appendix II).

EXPERIMENTAL.

I.—Botany.

7. The botanical work undertaken during the year consists partly in the continuation of the breeding of better types of Arabica and Robusta coffee and selection of hybrid progeny with a view to evolve strains suitable for the varying climatic and soil conditions of the coffee tracts of South India. In the case of Arabica coffee the most important consideration is the evolution of types immune or tolerant to 'leaf disease' (*Hemileia vastatrix* B. & Br.) consistent with good yields and commercial qualities. In the case of Robusta, the chief consideration is yield only. An important addition to the previous programme is the large scale vegetative propagation of the best types with a view to their multiplication and distribution to growers.

8. A.—Breeding:

(i) Arabica:— The breeding work during the year was largely a sequel to the work already in progress at Balehonnur. Besides this, some new selections were made from the Devamachy hybrid plots of the Margolly estate of the Consolidated Coffee Estates (1943) Ltd., Coorg. The following table summarises the breeding work done at Balehonnur station.

TABLE I.—Breeding of Arabica at Balehonnur (Mysore).

No	*Method*	*Purpose*	*Procedure adopted*
1	Selfing of desirable types.	To produce seeds for regional nurseries.	(a) 27 plants in S. 795 were covered with muslin bags when they were in blossom. (b) 49 plants in S. 645 were covered with muslin bags when they were in blossom. (c) 27 plants in S. 838 were covered with muslin bags when they were in blossom.
2	Hybridisation between promising parents.	do.	(a) Blossom was forced on 32 plants of S. 531 and the flowers were pollinated with pollen from S. 451 (Kents). (b) Blossom was forced on S. 26 and 16 clonal progeny from it, and the plants were pollinated with pollen from S. 451 (Kents).
3	Hybridisation between existing materials.	Search for new combinations.	1. (a) 645,3-3 x 826, 1-5 and reciprocal; (b) 645,5-2 x 826, 2-2; 2. Woger, 1-12 x 446,2 5 (Kent); 3. (a) 836,1-10 x 210, Maragogype, 2-14; (b) do x 645, 2-11; (c) do x 286, 1-7 (Kent); (d) do x Coorg, 6-12; (e) do x 881, 3-10 and (f) selfing;

No.	*Method*	*Purpose*	*Procedure adopted*
3	Hybridisation between existing materials.	Search for new combinations.	4. (a) 885, 2-6 x 314, 1-4 (Robusta of small bean type and reciprocal) ; (b) do x 836, 1-10 ; 5. (a) 905, 1-7 x Coorg, 6-12 ; do x 286, 1-7 (Kent) ; (c) do x 645, 4-11 ; (d) 905, 2-12 x 210, Maragogype, 2-7 ; (e) do x 645, 2-11 ; (f) 905, 3-9 x 286, 1-7 (Kent) ; (g) do x Coorg, 6-12 ; 6. 881, 3-6 x 988, 4-11 and its reciprocal ; 7. 881, 3-10 x 836, 1-10 ; 8. 882, 2-5 x S. 31 ; 9. 877, 2-3 x 645, 6-7 ; 10. 645, 6-7 x 988, 1-15 ; 11. (a) 645, 2-11 x 988, 4-11 ; (b) do x 988, 1-15 and its reciprocal ; (c) do x 210, Maragogype, 1-16 and its reciprocal ; 12. (a) 988, 4-11 x 210, Maragogype, 1-16 and its reciprocal ; (b) do x 881, 3-6 ; (c) do x 645, 6-7 ; 13. (a) 988, 1-15 x 882, 2-5 ; (b) do x 446, 1-6 (Kent) ; 14. 210, Maragogype, 2-14 x 645, 2-11 ;
4	Selfing of desirable selections.	For raising further progeny.	1. Selections from 4th generation of S. 26 ; 2. do from 3rd generation of S. 31 ; 3 do from F_3 of S. 288 x Kent; 4. do from F_3 of S 288 x Maragogype ;

9. In Coorg, promising hybrid material in Devamachi plots, believed to be the F_2 generation of a natural cross between Robusta and Arabica, was multiplied vegetatively for introduction at the two research stations. Besides this, seeds from nine promising plants were collected and sown to study the behaviour of the subsequent generation. Further hybridisation of selected Devamachi hybrid plants was attempted using Kent and robusta pollen in order to see whether some of the inherent defects in these plants could be overcome.

10. (ii) **Robusta**—The work started at Sidapur (Coorg) in 1942 for the selection of Robusta was continued. Out of 1,800 plants for which individual yield records were maintained for six years, ten were finally selected for vegetative propagation and softwood cuttings obtained from suckers were planted in propagation frames for rooting. In view of the well-known self sterility of this species, eight of these selections were divided into four pairs and cross pollination effected between the units in each pair to exploit the possibility of obtaining progeny exhibiting the phenomenon known as 'hybrid vigour'.

11. (iii) **Character studies.**—The produce from promising selections of Arabica and Robusta were collected and studies of such characters as yield, outturn, lights (*Jollu*), triage, the percentage of various grades etc. continued to receive attention. The following tables give a summary of these studies made during the year.

TABLE II.—Yield Records of some Balehonnur Station Selections

Arabica Selections					Robusta Selections			
Serial No.	Selection Number	Year of planting	Calculated yield in lb. of ripe cherry per acre (1200 plants) during		Selection number	Year of planting	Calculated yield in lb. of ripe cherry per acre (680 plants) during	
			1947	1948			1947	1948
1	S. 26 (Clones)	1940	3930	3186	S. 271	1931	2550	7565
2	S. 31	1940	4626	6128	S. 272	,,	5105	7464
3	S. 288	1932	1606	4146	S. 273	,,	4888	6276
4	S. 838	1942	4406	919	S. 274	,,	11024	9939
5	S. 333	1934	6886	6750	S. 275	,,	5842	9712
6	S. 645	1939	4399	4349	S. 276	,,	5383	8503
7	S 795	1941	2430	4058	S. 277	,,	3979	8257
8	S. 327	1934	3525	4128	S. 278	,,	4043	3428
9	S. 704	1940	1818	2155				
10	S. 434	1935	1686	1120				
11	S. 433	1935	1417	1671				
12	S. 574	1938	2803	1998				

TABLE III.—Some character studies of Balehonnur Station Arabica and Robusta Selections made during 1947-48.

Selections	% lights (by wt.)	Quantity of Cherry required to get 1 lb. of clean coffee	% Triage	% 'A' Grade	% 'B' Grade	% Peaberry	Average weight of 100 A Grade beans in grammes
Arabica Selections							
S. 26	18.5	10,1	22.5	21.3	18.0	37.6	18.5
S. 31	4.7	6.8	11.4	51.2	13.5	23.9	17.8
574, 3-12	6.7	4,8	13.6	27.1	34.0	23.7	20.3
S. 574	5.0	10,5	11.8	18.3	36.6	30.1	20.4
S. 288	8.0	8.2	22.5	35.8	20.3	21.1	16.8
S. 706	4.3	5.9	12.3	45.5	16.6	25.2	19.9
S. 645	4.1	5.3	17.0	38.6	20.2	23.1	19.0
S. 795	1.4	5,2	14.2	32.0	42.6	8.5	19.1
S. 433	16.5	10,1	20.6	32.2	16.1	30.8	20.3
S. 434	4.8	6 6	28.2	24.1	10.9	36.2	20.1
S. 704	7 1	4.5	18.1	33.7	24.1	23.6	20.5
Robusta selections							
274. 1-11	0	4.0	4.3	65.8	5.8	23.6	21.8
274. 2-1	3.3	5 1	4.2	55.6	33.3	5.6	18.5
274. 2-6	4.9	4.8	8.8	41.2	35.3	13.2	18.4
274. 3-5	0	4 3	5.8	51.4	22.8	20.0	19.0
274. 3-12	0	5.0	2.9	6.8	57.1	19.0	18.4
274. 3-13	4.5	4,8	8 2	49.3	16.4	26.0	19.4
274. 4-1	7.2	4.7	5.2	50.0	37.5	6.3	20.4
274. 4-12	2.8	5.2	7.3	49.0	19.4	24.3	18.5
272. 1-13	3.1	6.6	8.1	58.1	16.4	16.1	20.6
273. 4-10	3.6	4.0	1.8	32.1	32.1	30.4	19.1
276. 1 9	24,0	5 0	4.4	2.3	59.5	14.0	...
276. 3-13	3.4	4.9	8,6	61.1	16.1	13.4	18.5
276. 4-7	6.4	5.3	3.1	2.9	62.0	7.7	...

12. (iv) **Extension work with selections :—** The following quantities of seeds from Balehonnur Station selections were distributed during the year :—

Arabica Selections	*Quantity of seeds* lb.	oz.
S. 288 ...	12	12
S. 333 ...	8	0
S. 645 ...	19	12
S. 795 ...	20	12
S. 838 ...	3	8
S. 704 ...	0	8
S. 433 ...	10	0
S. 434 ...	10	0
Total ...	85	4
Robusta Selections		
S. 274	129	0
Grand Total ...	214	4

13. The increasing popularity of the Station selections is revealed in the progressive demand for seed and the ever-widening range of their distribution. One of these strains, S.288, apart from its resistance to Leaf disease and the consequent increased yield, has been reported from one of the estates to be resistant to eelworm (*Anguillulina pratensis*). This character is being watched with interest. The following table gives an idea of the distribution of the selections.

TABLE IV.—Number and distribution of estates growing Balehonnur Station selections.

Areas	Number of estates growing						
	S.288	S.333	S.433	S.434	S.795	S.645	S.704
Bababudangiri ...	17	11	6	13	6	4	...
Belur ...	2	..	1	1	...	..	...
Sakalespur ...	12	6	6	10	2	2	...
Mudigere ...	7	...	2	1	1	...	...
Aldur ...	3	1	...	..	...	..	...
Balehonnur-Koppa ...	7	10	6	6	4	3	1
Chamarajanagar ...	1	...	...	..	1	1	...
Coorg ...	15	8	4	7	7	7	...
Shevaroys ...	1	...	..	1	1	1	...
Nilgiris ...	4	1	1	1	2	1	...
Foreign ...	...	1	...	...	...	...	...
Total ...	69	38	26	40	24	19	1

14. (v) **Expansion of Selections at Balehonnur station and introduction at Chethalli sub-station:**—The following is a list of selections from which seedlings are raised for planting at the main station at Balehonnur and the sub-station at Chethalli, with a view to make further selections from these.

Selections.	*No. of Seedlings raised.*
At Balehonnur Station.	
3rd generation of S. 26	100
F_3 of S. 288 X Maragogype	300
F_2 of S. 288 X Kent	800
F_2 of S. 288 X (S. 288 X Maragogype)	128
F_2 of (S. 26 X Kent) X (S. 288 X Maragogype)	100
2nd generation of S. 31	250
3rd generation of S. 31	400
F_2 of S. 31 X S. 22	200
F_3 of S. 31 X S. 22	190
F_2 of S. 31 X Netraconda Hybrid (Selections)	160
F_3 of S. 31 X S. 353 (1st generation of S. 44)	100

At Chethalli Sub-station:

S. 288 (Arabica)	S. 274 (Robusta)	46—20 (Robusta)
S. 838 ,,	58—16 ,,	28—6 ,,
S. 645 ,,	63—8 ,,	58—31 ,,
S. 795 ,,	49—28 ,,	58—14 ,,
S. 446 ,,	57—2 ,,	53—28 ,,
S. 712 ,,	53—33 ,,	

15. (vi) **Training of personnel:**—Field assistants deputed by planters were trained at the main Station at Balehonnur in grafting and budding technique.

16. **B. Vegetative Propagation:**—The most rapid method of propagating desirable mother plants on a large scale without loss of parental characters is by means of vegetative propagation. Previous trials made at Balehonnur have proved the utility of budding and wedge-grafting in vegetative multiplication. But the scope of such means of multiplication is obviously limited. In order that coffee growers throughout the country may benefit from the breeding work, it was decided to resort to large-scale multiplication of desirable mother plants by the rooting of soft wood cuttings from suckers. The experience gained at Sidapur (Coorg) with Robusta coffee and the success obtained by workers in Tanganyika with Arabica coffee came in handy to make a beginning. Sixty plant propagation chambers were constructed at the two research stations and

about 6,000 selected sucker cuttings were planted in these. Advantage was also taken of the wet and humid monsoon conditions to try the rooting of cuttings in open sand beds which could be protected from direct sun by an adjustable overhead screen of hessian. Experiments were laid out in the chambers and beds to study the relative merits of synthetic and natural hormones in the rooting of cuttings. Though it is too early to record results, the negligible number of failures among the cuttings gives promise of success.

17. Besides the above method of propagation from soft-wood sucker cuttings, preliminary trials are in progress to study the possibility of raising plants from pre-cured leaf-bud cuttings.

18. **TABLE V—Rooting of cuttings of Robusta.**

EXPERIMENT I.—*Effect of natural and synthetic hormones on single-noded leafy cuttings (open beds during monsoon).*

No. of cuttings used in each treatment : 105. Locality : Sidapur (Coorg).

	A Control	B Indole-butyric acid	C Phenyl acetic acid	D Cow's urine extract	E Horto-mone A
Percentage of rooting	61.0	62.9	75.2	87.6	61.0

The above table shows that cow's urine extract and phenyl acetic acid increase the rooting of the cuttings.

EXPERIMENT II.—*The effect of hormones on single and double noded leafy cuttings in open beds during monsoon.*

No. of cuttings in each treatment : 108. Locality : Sidapur (Coorg).

Nature of cuttings	Percentage of rooting			Remarks
	A Control	B Phenyl acetic acid	C Cow's urine extract	
Single noded	50.9	50.0	...	In single noded cuttings the top cut was about ½ inch above the node and the bottom cut about 1 inches below the node. In double noded cuttings the bottom cut was through the bottom node while the top cut was about ½ inch above the top node.
Double noded	35.2	45.4	66.7	

The experiment shows that during the monsoon, rooting of cuttings is possible in open beds. While the two hormones are beneficial, single-noded cuttings are definitely better than double noded cuttings.

EXPERIMENT III.—*The effect of hormones on single noded leafy cuttings in beds under shelter (thatched shed) during monsoon.*

No. of cuttings in each treatment : 105. Locality : Sidapur (Coorg).

	A Control	B Indole-butyric acid	C Phenyl acetic acid	D Cow's urine extract	E Hortomone A
Percentage of rooting	45.7	29.5	36.2	52.4	45.7

The above experiment shows that in rooting of cuttings during the monsoon period in beds under shelter, the effect of hormones is not conspicuous, except in the case of cow's urine extract.

EXPERIMENT IV.—*The effect of hormones on single and double noded leafy cuttings in beds under shelter (thatched shed) during monsoon.*

No. of cuttings in each treatment : 108. Locality : Sidapur (Coorg).

Nature of cuttings	Percentage of rooting		
	A Control	B Phenyl acetic acid	C Cow's urine extract
Single noded ...	28.7	20.4	...
Double noded ...	13.9	20.4	45.4

As compared with the results given under Experiment II, both double and single noded cuttings root less under shelter.

This experiment being complementary to Experiment II where cuttings were planted in the open, the results show that both double and single noded cuttings produce poorer percentage of rooting under shady conditions. It also indicates that double noded cuttings are less affected by providing shelter over the beds.

EXPERIMENT V.—*The effect of retaining leaves on the rooting of cuttings (experiment done in a wooden propagation chamber). Locality : Sidapur (Coorg).*

	Leafy cuttings	Leafless cuttings
Number of cuttings planted in September ...	180	101
Percentage of rooting or callusing in January ...	72.8	25.7

19. C. Green Manure Crops :— The importance of organic matter in the coffee soils of certain tracts of South India cannot be over-emphasised. A start was therefore made with a collection of leguminous plants grown at various altitudes as a green manure. These have been raised in specimen plots at both stations for studies of their behaviour under local

conditions and incidentally for multiplication of seed. Some trials were commenced to observe their growth under shady conditions. The following is a list of species under trial :—

1. *Crotalaria striata*
2. *C. lanata*
3. *C. Grahamiana*
4. *C. fulva*
5. *C. gigantea*
6. *C. usaramoensis*
7. *C. anagyroides*
8. *C. juncea*
9. *Indigofera arrecta*
10. *I. dosua*
11. *Calopogonium mucunoides*
12. *Centrosema pubescens*
13. *Peuraria javanica*
14. *Cassia hirsuta*
15. *C. didymobotrya*
16. *Tephrosia candida*
17. *T. Vogelii*
18. *Cajanus cajan*
19. *Glycine hispida*
20. *Phaseolous trilobus*
21. *Lupinus sp.*
22. *Sesbania speciosa*
23. *S. aculeata*

II. CHEMISTRY.

20. For want of laboratory facilities and inadequacy of equipment, the work under this section was largely confined to the continuation of the field experiments started previously. The following are the results of experiments in progress :—

Manurial Experiments :

21. (1) Experiment I.— *New Manurial Series, Balehonnur (Mysore).* The experiment was laid out in 1936, planting done in 1937 and manuring commenced in 1940. The following is the annual rate of application of manures.

Nitrogen (N) at 20 lb. per acre (75 per cent as ground-nut oil cake and 25 per cent as ammonium sulphate).

Phosphoric acid (P_2O_5) at 30 lb. per acre (as super-phosphate, single or concentrated).

Potash (K_2O) at 40 lb. per acre (half as sulphate and half as muriate of potash).

Lime (since 1943) at half ton (hydrated lime) per acre as basal dressing. The shade in this experimental area being exclusively provided by bamboo slats, provision is made to supply dry leaf mulch at 5,000 lb. per acre, twice a year, in order to simulate conditions otherwise obtaining under natural shade. Since 1945 due to the unavailability of sulphate and

muriate of potash, coffee husk ash was substituted to provide the calculated amount of K_2O. To prevent seepage of water from one plot to another, the sub-plots are separated from one another by concrete slabs three feet wide of which 2½ feet are buried in the soil. Five subsoil drains filled with rouble, run along the length of the experimental area immediately below the concrete slabs. The manures were mixed immediately prior to application. Leaf mulch around the plants was swept apart and the mixture applied in the form of a circular band 1½ inches wide about one foot away from the stem. The manure was lightly incorporated into the soil before re-covering the soil surface with the mulch. Lime was applied broadcast. Regular hand weeding was done besides the annual digging operation in the field. The results of the experiment are furnished below.

Area of experimental plot : 76 cents — *Layout* : Latin square
No. of plants per sub-plot : 5 x 8 — *Spacing* : 5 ft. x 5 ft.
Variety : Kent's Arabica — *Guard-rows* : One row all round

TABLE VI.—Yield records of Permanent Manurials. Coffee Research Station, Balehonnur.

Year	Average calculated yield of ripe cherry in pounds per acre					Significant or not	Critical difference (P=0,05)	Conclusion
	TREATMENTS							
	N A	N+B B	N+K C	N+P+K D	Control E			
1941 ...	791	663	918	918	553	No	513	$\overline{CDABE}$
1942 ...	1250	1207	1335	1360	740	Yes	436	$\overline{DCAB},E$
1943 ...	60	89	113	85	43	Yes	16	$C,\overline{BD,AE}$
1944 ...	255	213	306	264	204	No	147	$\overline{CDABE}$
1945 ...	1267	1233	1662	1913	803	No	1168	$\overline{DCABE}$
1946 ...	400	531	332	595	510	No	411	$\overline{DBEAC}$
1947 ...	468	697	714	697	587	No	379	$\overline{CDBEA}$
1948 ...	281	306	306	255	272	No	498	$\overline{BCAED}$
Average for 8 years ...	597	617	711	761	464	...	...	...

There was no response to manurial treatment in six out of eight years during which yields were recorded. In 1942 all the four treatments (A,B,C & D) were superior to Control (E), but among themselves there was no significant difference. In 1943 also, all treatments were better than control, but C was significantly superior to B and D. However, the yields during this year were phenomenonly low. From an overall picture of this experiment, the trends are towards higher yield with manurial applications, but not commensurate with the cost. There is no depressing effect due to any of the manurial ingredients. The results suggest that the present dosages are inadequate.

22. (ii) Manurial Experiments on Private estates.

Series I.

Annual rate of manuring : N : 20 lb. per acre
P_2O_5 : 30 lb. ,,
K_2O : 40 lb. ,,
} Treatment same as in new Manurial series at Main Station, Balehonnur.

Area of Experimental plot : 1.43 acres
Lay out . . . Latin square 5 x 5
Variety . . . Kent's Arabica
Shade . . . Natural shade

No. of plants per sub-plot :
Gross 10 x 7
Nett 8 x 5
Spacing . . . 6 ft. x 6 ft.

TABLE VII—Results of co-operative Manurial Experiments, Santaweri Estate (Mysore).

Year	Average calculated yield of ripe cherry in pounds per acre — TREATMENTS					Significant or not	Critical difference (P=0.05)	Conclusion
	N A	N+P B	N+K C	N+P+K D	Control E			
1940 ...	1290	1440	1902	1110	2376	No	1170	ECBAD
1941 ...	1260	1371	1908	1128	2286	No	1429	ECBAD
1942 ...	2166	2196	1794	1812	2658	No	890	EBADC
1943 ...	2352	2616	2664	2538	2580	No	769	CBEDA
1944 ...	678	522	612	462	732	No	264	EACBD
1945 ...	2466	3348	2778	2941	2904	No	766	BDECA
1946 ...	3318	3432	3210	2418	2712	No	785	BACED
1947 ...	2352	2460	2484	2520	2628	No	1107	EDCBA
1948 ...	3702	4194	3420	3000	3636	No	1950	BAECD
Average for 9 years ...	2176	2398	2308	1992	2501	...	...	...

Treatments have not been significant. There is no response to manuring in any of the nine years during which results were recorded. On the other hand, the results though not significant, indicate a depressing effect with complete fertilizers and with nitrogen, which is more than with combinations of nitrogen either with potash or phosphoric acid.

TABLE VIII—Results of co-operative manurial experiments. Watekan Estate (Mysore).

Year	Average calculated yield of ripe cherry in pounds per acre — TREATMENTS					Significant or not	Critical difference (P = 0.05)	Conclusion
	N A	N+P B	N+K C	N+P+K D	Control E			
1940 ...	1686	1476	1620	1662	1428	No	609	$\overline{ADCBE}$
1941	Results not recorded							
1942 ...	930	708	978	672	696	No	333	$\overline{CABED}$
1943 ...	960	1422	1050	834	1116	No	553	$\overline{BECAD}$
1944 ...	2244	1884	2352	2892	1950	Yes	750	D, $\overline{CAEB}$
1945 ...	2406	2808	2688	2874	3618	No	1148	$\overline{EDBCA}$
1946 ...	3204	2988	3864	3648	2700	Yes	817	$\overline{CD}\,\overline{ABE}$
1947 ...	4158	4224	3966	4014	4842	No	1637	$\overline{EBADC}$
1948 ...	1710	960	866	936	936	No	933	$\overline{ABDEC}$
Average for 8 years ...	2162	2059	2173	2191	2160	...	...	...

Treatments have not been significant except in 1944 when D was superior to the rest, and in 1946 when C and D were superior to E and C was superior to B and E. In this experiment there is no response to manuring in six out of eight years.

TABLE IX.—Results of Co-operative Manurial Experiments Kirgandur Estate (Coorg).

Year	Calculated yield of ripe cherry in pounds per acre TREATMENT N A	N+P B	N+K C	N+P+K D	Control E	Significant or not	Critical difference (P=0.05)	Conclusion
1940 ...	1362	1320	1242	1062	1362	No	416	$\overline{EABCD}$
1941 ...	2562	2106	2286	2796	2124	No	1262	$\overline{DACEB}$
1942 ...	1088	1020	1338	1008	846	Yes	430	$\overline{CABDE}$
1943 ...	1368	1818	1566	1608	1542	No	528	$\overline{BDCEA}$
1944 ...	5076	5724	5712	4056	4860	No	1286	$\overline{BCAED}$
1945 ...	4914	3948	3900	4188	3906	Yes	992	A, $\overline{DBEC}$
1946 ...	3595	3912	4189	3269	3707	No	852	$\overline{CBEAD}$
1947 ...	3408	3132	4080	4672	3366	No	912	$\overline{CDAEB}$
1948 ...	366	606	330	276	300	Yes	242	B, $\overline{ACED}$
Average for 9 years ...	2638	2621	2727	2437	2446	...	...	...

There is no response to manuring in six out of nine years. In 1942 C is superior to E, in 1945 A is superior to D, B, E and C. In 1948, B is superior to A, C, E and D. In no year is there significant response to a complete fertilizer (N+P+K).

TABLE X.—Results of Co-operative Manurial Experiments Gargandur Estate (Coorg).

Year	Calculated yield of ripe cherry in pounds per acre TREATMENT N A	N+P B	N+K C	N+P+K D	Control E	Significant or not	Critical difference (P=0.05)	Conclusion
1940 ...	979	937	1047	1211	709	Yes	407	$\overline{\text{DCABE}}$
1941 ...	1924	1802	2103	2572	2700	No	929	$\overline{\text{EDCAB}}$
1942 ...	2132	1792	2338	2669	1707	No	1086	$\overline{\text{DACBE}}$
1943 ...	1291	401	564	378	899	No	735	$\overline{\text{AECBD}}$
1944 ...	2814	3492	4200	4248	3294	No	1092	$\overline{\text{DCBEA}}$
1945 ...	2148	1494	1956	1428	2070	No	920	$\overline{\text{AECBD}}$
1946 ...	2279	2345	3279	2571	2474	No	1010	$\overline{\text{CDEBA}}$
1947 ...	2742	2580	3120	2724	2970	No	468	$\overline{\text{CEADB}}$
1948 ...	126	90	78	54	72	No	83	$\overline{\text{ABCED}}$
Average for 9 years ...	1826	2656	2076	1984	1877	...	...	...

There has been no response to manuring except in 1940, the year of starting of the experiment, when D is superior to E. In all other years, none of the treatment has shown any superiority over 'no manure'. In most of the seasons, a depressing effect of N+P combination is discernible.

Series II.

23. *Bulky v. concentrated manures*:—The results of another series of experiments started in 1939 and 1942 to study the relative merits of bulky and concentrated manures are as follows:—

EXPERIMENT I.—*Locality*: *Netracanda (Mysore)*.

Annual rate of manuring: N: 20 lb. per acre
P O : 30 ,,
K_2O : 40 ,,

Area of Experimental plot: 1.83 acres — *Layout*: L tin square 4 x 4

Variety: Kents — *No. of Plants per sub-plot* 13 x 11

Outskirts: One row all round.

Shade: Natural shade — *Spacing*: 6 ft. x 6 ft.

Treatment A—Compost to provide 20 lb. nitrogen *plus* superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lbs. P_2O_5 and 40 lbs. K_2O.

B—15 lb. of nitrogen as ground-nut cake and 15 lb. of nitrogen as ammonium sulphate *plus* superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O respectively.

C—Compost to provide 10 lb. nitrogen and the balance of 10 lb. nitrogen as a mixture of ground-nut cake and ammonium sulphate *plus* enough superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O respectively.

D—Control (No Manure).

Table XI.—Results of bulky v. Concentrated Manures Experiment. Netrakonda Estate (Mysore).

Year	Average yield of ripe cherry in pounds per acre					Critical difference (P =0,05)	Conclusions
	TREATMENT						
	Half bulky + half concentrated A	Bulky B	Concentrated C	Control D	Significant or not		
1940 ...	424	596	549	502	No	394	$\overline{BCDA}$
1941 ...	900	882	824	888	No	579	$\overline{ADEC}$
1942 ...	748	743	867	703	No	763	$\overline{EABD}$
1943 ...	112	111	115	173	No	183	$\overline{DCAB}$
1944 ...	615	636	712	667	No	403	$\overline{CDBA}$
1945 ...	1140	1206	1335	1381	No	1484	$\overline{DCBA}$
1946 ...	1967	1624	1254	1318	No	932	$\overline{ABDC}$
1947 ...	909	1041	1123	902	No	332	$\overline{CBAD}$
1948 ...	152	224	127	143	No	86	$\overline{BADC}$
Average for 9 years ...	774	785	767	742	...	...	...

... not been significant and there is no response to any ... m ...urial ...reatments during the nine years of experimentation.

Series III.

EXPERIMENT II.—*Bhoothanhudloo (Coorg).*

Annual rate of manuring: *A*—No manure (Control).

B—Cattle manure—5 tons per acre.

C—Cattle manure 5 tons *plus* 30 lb. of N in the form of ground-nut cake and 40 lb. P_2O_5 as bonemeal.

D—Cattle manure 5 tons *plus* 30 lb. of N as groundnut cake, 40 lb. P_2O_5 as steamed bonemeal and 50 lb. K_2O as muriate of potash.

E—N 30 lb. as groundnut cake *plus* 40 lb. P_2O_5 as steamed bonemeal and 50 lb. K_2O as muriate of potash.

Area of Experimental block : 1.28 acres
Variety : Kent's Arabica
Shade : Natural shade

Lay out : Latin square 5 x 5
Spacing : 6 ft. x 6 ft.
No. of plants per sub-plot :
Gross 8 x 8 ; Nett 6 x 6

TABLE XII.—Results of manurial experiments, Buthanhadloo (Coorg).

Period	Yield of ripe cherry in pounds per Acre								
	A	B	C	D	E	Significant or not	Standard error	Critical difference	Conclusion
1943 ...	1881	1782	1584	1584	1485	No	365	1124	ABCDE
1944 ...	1584	1221	1518	1584	1881	No	315	970	EADCB
1945 ...	4138	4112	3663	3854	3346	No	316	974	ABDCE
1946 ...	318	251	86	165	185	Yes	75	231	ABEDC
1947 ...	1749	1439	1432	1228	1016	No	192	593	ABCDE
1948 ...	2970	3399	2574	2831	2780	No	291	898	BADEC
Average of six years	2106	2034	1809	1874	1782	...	...	...	

There is no response to manuring in all the trials. On the other hand, there is an apparent depressing effect, which is less with cattle manure, and more with its combinations with fertilizers and fertilizers alone, except in 1944.

III. AGRONOMY.

24. *EXPERIMENT I.—To study the effect of pruning in relation to spraying.*

Treatments : A—Spraying alone (Pre- and Post-monsoon treatments)
B—Pruning
C—Spraying plus pruning
D—Control

Area of Experimental block : 2.05 acres
Variants . . . 4
Replications . . . 4
Variety . . . Coorgs
Shade . . . Natural shade
Lay out . . . Factorial design 2 x 2
Outskirts . . . One row all round
Spacing . . . 6 ft. x 6 ft.
No. of plants per sub-plot :
Gross 20 x 8 ; Nett 18 x 6

TABLE XIII.—The effect of pruning and spraying.

Locality	Period	Yield of Ripe Cherry in lb. per acre			
		A	B	C	D
Palehonnur (Mysore)	Average for 1940-48	1598	770	1362	690
	1948 ...	2530	1050	2455	988

EXPERIMENT II.—To study the effect of pruning.

Treatments . A—Light hot weather pruning
B—Light monsoon pruning
C—Medium hot weather pruning
D—Medium monsoon pruning
E—Control

Area of experimental block : 2.71 acres
Variety . . . Coorg
Shade . . . Natural shade
Lay-out . . . Latin square 5 x 5
Outskirts . . . One row all round
Spacing . . . 6 ft x 6 ft.
No. of plants per plot :
Gross 10 x 13 ; Nett 8 x 11

TABLE XIV.—Results of Pruning Experiments.

Effect of Time and Degree of Pruning on Leaf-counts and yield in pounds per Acre.

Locality	Treatments	Leaf-counts					Yield		
		Feb. 46	Sept. 46	Feb. 47	Sept. 47	Feb. 48	1946	1947	1948
Ghattedhulla (Coorg)	A	24.0	49 7	13.2	25.8	23.1	1346	2706	1754
	B	28.6	44.2	13.1	23.7	23.6	1224	2530	1782
	C	23.9	38 1	15.4	25 8	24 5	1020	3196	1686
	D	32.4	50.8	14.2	29.4	23.0	938	2652	2176
	E	25 2	47.4	13 2	25.3	22 6	1510	2708	2285
	Significant or not	Yes	Yes	Yes	No	No	Yes	No	No
	Std. error	2,60	4 09	0.65	2,69	0.85	123	316	378
	Critical Difference	8.1	12 6	2.0	8.3	2.7	378	975	1164
	Conclusions	DBEAC	DAEBC	CDAEB	DACEB	CBADE	EABCD	CAEDB	CBADE

In this locality, medium monsoon pruning gives better leaf-counts than others, which is not correlated to the yields recorded. The different kinds of pruning tried, do not induce better yields over the control.

25. *EXPERIMENT III.—To study the effect of pruning.*

Treatments : A—Light pruning
B—Medium pruning
C—Heavy pruning
D—Control.

Area of Experimental block : 2.05 acres
Variety . . Coorg
Shade . . Natural shade
Lay out . . Latin square 4 x 4
Outskirts . . One row all round
Spacing . . 6 ft. x 6 ft.
No. of plants per sub-plot :
Gross 8 x 20 ; Nett 6 x 18

TABLE XV.—Results of pruning Experiments.

Locality	Period	Yield in lb. and oz. of ripe cherry			
		A	B	C	D
Balehonnur (Mysore)	1940	815-2	573-12	597-8	631-2
	1941	436-12	383-4	179-0	372-10
	1942	507-12	344-6	583-14	339-4
	1943	155-4	118-12	87-10	114-0
	1944	224-8	130-12	44-12	170-8
	1945	1296-4	1253-0	1066-0	1073-10
	1946	48-6	52-6	46-12	50-14
	1947	261-4	182-12	88 8	214-14
	1948	515-4	578-4	607-12	456-12

Note.—The above yield figures were not converted to acre yields, nor their statistical analyses worked out.

IV. PLANT PROTECTION.

26. A.—COFFEE DISEASES:

(i) Leaf Disease (*Hemileia vastatrix* B. & Br.)

EXPERIMENT I.—*The strength of Bordeaux mixture and use of spreader.*

The cumulative results of this experiment up to 1948 is furnished below:—

Locality : Balehonnur (Mysore)

Lay out : Split plot technique.

Main . . 4

Sub. . . 2

Replications . 6

Main treatments :

A—Bordeaux mixture . . 2—2—40

B— do . . 4—4—40

C— do . . 6—6—40

D— do . . 8—8—40

Sub-treatments :

E. With spreader (linseed oil at 8 oz. per 40 gal.)

F. No spreader.

TABLE XVI.—Leaf counts and yield in lb. of ripe cherry per acre.

Treatment	Leaf survival observations						Yield of cherry in lb. per acre	
	Sept. 1945	Feb 1946	Sept. 1946	Feb. 1947	Sept. 1947	Feb. 1948	1947	1948
A	30,5	15 6	42,2	13,5	24.8	20.1	7.87	1699
B	32.3	18.8	44 8	21,6	27.1	24,0	1013	1866
C	32.8	23.1	39,4	25,5	26.1	25.9	1052	1679
D	39.5	25.3	43.8	27,7	26.4	26.8	1079	1742
Significant or not	Yes	Yes	Yes	Yes	No	Yes	No	No
Standard error	1 70	1.10	1,70	1.20	1.37	0.75	97.2	140,3
Critical difference	5,0	2,2	5,2	3.6	4,1	2.2	293	422
Conclusions	DCBA	DCBA	BDAC	DC,B,A	BDCA	DCBA	DCBA	BDAC
E	33.7	21 6	42,4	22.5	26.0	23.9	977	1696
F	33 8	20,3	42,7	21,7	26.1	24,5	988	1795
Significant or not	No	No	No	No	No	No	No	No
Standard Error	1 86	0,40	0.78	0 37	0,78	0,37	39.48	46.92
Critical difference	5.5	1.3	2.3	1,1	2,3	1,1	116.4	138.0
Conclusions	FE	EF	FE	EF	FE	FE	FE	FE

September Leaf-counts.—The three higher strengths over 2-2-40, do not show any increased leaf survival except in 1945, when the highest strength is better than others.

February Leaf-counts.—The two higher strengths D and C, consistently show better retention of leaf than B and A. Between B and A the superiority of B is marked.

Yield.—The difference in leaf-survivals noted is not borne out in the yields. The higher strengths do not induce any significant increased yields, over 2-2-40, to merit their adoption.

Spreader.—The addition of spreader has not shown any significant effect, either in leaf-counts or yield, over plain 'Bordeaux mixture'.

27. EXPERIMENT II.—*Time and strength of spray.*

Locality : Coorg

Lay out : Split plot design :
Main . . 3
Sub. . . 2
Replicans . . 6

TABLE XVII.—Results of Time and Strength of spray.

Treatments	Leaf survival observation								Yield of ripe cherry in lb. per acre		
	Sept. 1944	Feb. 1945	Sept. 1945	Feb. 1946	Sept. 1946	Feb. 1947	Sept. 1947	Feb. 1948	1946	1947	1948
A. Pre-monsoon	47.9	9.8	48.3	16.5	43.6	24.4	26.9	16.0	1740	2620	1820
B. Pre- & post monsoon.	46.5	13.1	50.7	21.8	45.2	31.7	29.7	20.1	2900	2420	2640
C. Post-monsoon	26.6	11.6	27.4	20.5	20.2	22.3	15.2	21.3	2020	1920	1320
Significant or not	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard Error	0.803	0.314	1.069	0.517	1.069	0.900	0.586	0.828	5.66	13.1	11.83
Significant difference.	2.3	0.9	3.1	1.5	3.1	2.6	1.7	2.4	114	380	320
Conclusions	A,B,C	B,C,A	B,A,C	B,C,A	B,A,C	B,A,C	B,A,C	C,B,A	B,C,A	A,B,C	B,A,C
E. Bordeaux 4-4-40.	41.9	12.0	41.7	20.3	36.8	26.8	24.6	19.4	2380	2240	2100
F. Bordeaux 2-2-40	38.8	11.0	42.6	18.9	35.8	25.5	23.4	18.9	2060	2400	1760
Significant or not	Yes	Yes	No	Yes	No	No	No	No	Yes	No	Yes
Standard Error	0.688	0.250	0 786	0.393	0.715	0.857	0.679	0.357	4.79	6.43	10.71
Significant difference.	1.9	0.7	2.2	1.1	2.0	2.4	1.9	1.1	134	180	300
Conclusion	E,F	E,F	F,E	E,F	E,F	E,F	E,F	E,F	E,F	F,E	E,F

Time of Spray.

Leaf-counts.—1 (a) In all September observations, B is equal to A, except in 1947 when it is better than A. In all other observations, B and A are superior to C.

(b) In February observations, B is superior to A in all years. Between B and C, B is superior in all years except in 1946 and 1948 when it is equal to C. Between A and C, C is superior in three out of four observations. The exception is in February 1947, when A is equal to C.

(2) *Yields.*—B is superior to C in all the three years and better than A in two years. A is better than C in two years but poorer in one year. The superiority of B over A and C is thus patent in leaf-survival and yields in most of the observations.

Strength of Mixture.

(1) *Leaf-counts.*—(a) In September counts, out of four observations F is equal to E in three, but poorer than E in one.

(b) In February counts, out of four observations, F is equal to E in two, but poorer than E in the other two.

(2) *Yield.*—Out of three seasons, E is superior to F in two seasons, while in 1947, E is equal to F. The above results are, however, not in agreement with the results obtained at Balehonnur.

28. *EXPERIMENT III.—The use of Spreader—Tee-pol X. Two sprays a year.*

Locality : Ghattedhalla (Coorg). Lay out : Randomised Block 4 x 6.

Treatment : A—Bordeaux 2-2-40

B—Bordeaux 2-2-40 with ½ oz. Teepol X in 40 gallons.

C—Bordeaux 2-2-40 with ½ oz. do

D—Bordeaux 2-2-40 with ¾ oz. do

TABLE XVIII.—Leaf counts and yield in lb. of ripe cherry per acre.

Date of observation	A	B	C	D	Significant or not	Standard Error	Critical difference
Leaf Survival.							
Sept. Oct. 1946 ...	23.7	32.0	33.2	29.4	Yes	2.96	6.3
Feb. Mar. 1947 ..	11.1	14.3	14.1	14.2	Yes	1.08	2.3
Sept. Oct. 1947 .	23.4	28.5	29.6	29.1	Yes	1.31	2.8
Feb. Mar. 1948 ...	15.7	16.6	18.4	18.1	Yes	0.89	1.9
Yield per acre of ripe cherry ...	3520	4840	4440	3680	...	...	...

Bordeaux mixture with Tee pol X induces more leaf retention in all observations. In yield the highest strength of Tee pol X shows a fall.

29. Another field experiment was started in June 1948 to study the relative merits of plain half per cent Bordeaux mixture and the addition of Teepol X and Albolineum respectively to Bordeaux mixture.

30. *EXPERIMENT IV.—Comparison of Bordeaux mixture with Peronox :*

Small scale field trials were conducted in 1947 to judge the relative merits of half per cent Bordeaux mixture and three strengths of Peronox. After the treatments, a generous dusting of spores of the leaf disease fungus was made on the leaves. Leaf survival and the number of pustules per surviving leaves were recorded.

TABLE XIX.—Bordeaux mixture v. Peronox.

Locality : Sidapur (Coorg).

Treatment	No. of nodes on observation date *	No. of leaves dropped presumably due to leaf disease	No. of pustules on surviving leaves
I set.			
Control	40		
Left leaf		31	200
Right Leaf		27	154
II set.	40		
Bordeaux 2-2-40		11	113
Peronox 1 in 40		14	297
III set.	43		
Bordeaux 2-2-40		5	32
Peronox $\frac{3}{4}$ in 40		11	232
IV set.	49		
Bordeaux 2-2-40		6	47
Peronox $\frac{1}{2}$ in 40		14	444

*Note—Some of the branches bearing the nodes under experiment were found either broken or missing.

31. *EXPERIMENT V.—Field experiments to compare Bordeaux mixture with Peronox.*

Locality : Palmad (Coorg) Lay out : Randomised Block 4 x 6.

Treatments : A—Bordeaux mixture 2-2-40
B—Peronox 1 lb. in 40 gallons of water
C—Peronox ¾ lb. in 40 gallons of water
D—Peronox ½ lb. in 40 gallons of water
} Two sprays per year

Observations recorded :—Leaf counts.

TABLE XX.—Bordeaux mixture v. Peronox.

Date of observation	A	B	C	D	Significant or not	Standard Error	Critical difference P=0.05	Conclusions
Sept. Oct , 1946 ..	24.4	23.8	21.1	24.0	No	1.60	4.7	$\overline{ADBC}$
Feb. Mar., 1947 ...	19.1	20.8	17.6	18.2	No	1.10	3.2	$\overline{BDAC}$
Sept. Oct., 1947 ...	35 6	36.1	32.2	30.2	No	1.90	5.6	$\overline{BACD}$
Feb. Mar. 1948 ..	17.8	14.8	16.0	14.7	Yes	0 71	2.1	$\overline{AC}\,\overline{BD}$

Leaf Counts :—In three out of four observations, Peronox is equal to Bordeaux mixture of 2-2-40 strength, but in the fourth observation Peronox is inferior to Bordeaux mixture in one and ½ lb. strengths of Peronox. The ¾ lb. strength, however, was equal to Bordeaux mixture in that year.

32. (ii) Black-rot - *Pellicularia* (*Corticium*) *koleroga* V. Hohnel.

Though the pre-monsoon spray with Bordeaux mixture has been established as the most effective control measure against Black rot, estates in certain localities in the heavy S. W. monsoon areas e. g. the Jagar Valley, continue to report the incidence of severe Black rot. An experiment was therefore laid out on an estate in this valley to study the optimum period for the application of the spray and the value of operations like handling the bushes prior to spraying. This experiment is in progress.

33. (iii) 'Black-bean' :—The following observations were made on the effect of spraying on the incidence of 'black bean'.

TABLE XXI.—Effect of spraying on Black bean.

Locality	Mean percentage of Black bean			Significant or not	Standard error	Critical difference	Conclusion
	Pre-monsoon A	Pre and post monsoon B	Post-monsoon C				
Kirgandur (Coorg)	9.0	5.4	8.6	Yes	0.29	0.92	$\overline{AC}$,B

Double spray reduces the incidence of black bean better than single spray.

34. B. Coffee pests.

White Stem Borer. (*Xylotrechus quadripes*, Chev.)

Studies on the period of emergence of the adult beetle were continued. A field cage was constructed enclosing nine old coffee trees and twenty beetles were let in between October and December, 1945. Periodical observations were made of the number of emergences during the succeeding four flight seasons and the beetles which emerged were collected and killed.

TABLE XXII.—Emergences in a field cage from coffee infected in October—December 1945.

Locality : Sidapur (Coorg).

Period of emergence	April-May 1946	Oct.—Dec. 1946	April—May 1947	Oct.—Dec. 1947
Number of Emergences ...	...	7	8	3

These results suggest that the life cycle of the insect which is normally about a year, can extend over a period of two years.

35. TABLE XXIII.—Cold and hot weather emergences from cages under sunny and shady conditions.

Locality : Sidapur (Coorg).

	1942-43		1943-44		1944-45		1945-46		1946-47		1947-48	
	Sun	Shade	Sun	Shade	Sun	Shade	Sun	Shade	Sun	Shade	Sun	Shade
Number of stems caged during June—September	250	250	108	108	406	406	252	252	200	200	400	400
Number of emergences in October—December following ..	72	34	32	24	339	235	233	119	152	54	160	101
Number of emergences in April—May following ...	Material destroyed		46	16	290	22	59	52	56	15	73	36

36. TABLE XXIV.—Emergences of beetles from infected stems collected in June, July, August and September, 1946.

Locality : Sidapur (Coorg).

Year	Number of stems collected each month	Emergences from stems collected in							
		June		July		August		September	
		Cold weather	Hot weather	Cold weather	Hot weather	Cold weather	Hot weather	Cold weather	Hot weather
1946-47 ..	Sun 50 ..	118	10	5	2	23	38	6	6
	Shade 50 ..	38	5	2	0	11	7	3	3
1947-48 .	Sun 100 .	39	29	35	9	61	33	25	2
	Shade 100 ...	32	5	25	15	33	12	11	4

37. Some preliminary trials conducted in insect-proof cages to study the utility of modern insecticides like DDT., BHC and DNOC in protecting coffee stems against borer attack gave encouraging results. Following this, a field experiment was laid out to study the effect of two proprietary preparations of DDT. and BHC. The former was used as a swab in a water suspension at the rate 4 lb. in 40 gallons of water (½% DDT.) while BHC. product was dusted on the stems at the rate of 6 to 12 lbs. per acre. The treatments were given twice a year during both flight periods for three years. The results are as follows:—

TABLE XXV.

Field experiment on insecticidal control of stem-borer.

Locality : Margolly (Coorg).

Block No.	No. of stems treated with		Control	No. of bored plants removed from treatments with		Control
	D.D.T. 50%	B.H.C. 5%		D.D.T.	B.H.C.	
I	113	156	96	7	2	8
II	281	153	66	5	3	1
III	128	166	48	4	1	7
IV	188	178	152	4	2	4
V	121	121	137	0	1	5
VI	110	116	119	2	3	6
VII	156	170	140	7	2	5
VIII	118	164	125	2	1	2
IX	125	164	114	8	2	1
X	153	179	126	3	3	5
XI	155	165	98	1	6	8
XII	146	149	106	6	1	1
XIII	122	116	104	4	1	5
XIV	136	109	98	3	2	1
XV	127	88	72	4	1	9
Total ...	2,179	2,194	1,601	60	31	68
Percentage of infection ...				2.7	1.5	4.2

38. The results show that both DDT. and BHC. have conferred some degree of protection to the plants. It is therefore proposed to make further trials with varying strengths of the insecticides.

39. C. Weed Control :—Preliminary studies were started with two proprietary weedicides - Methoxone, a 1% dilution of MCPA in dust. form, and Extar Sandoz. Observations showed that Methoxone was effective against succulent plants of *Bidens pilosa*, but ineffective against *Mimosa pudica* and *Oxalis corniculata*. Extar Sandoz was also effective against seedlings and half grown plants of *Bidens pilosa* but ineffective against *Mimosa pudica* and *Oxalis corniculata*. It is proposed to pursue this work during the ensuing dry weather.

V. MISCELLANEOUS CROPS.

40- (i) *Paddy* :—The existence of about seven acres of paddy land at Chethalli sub-station was utilised during 1948 to grow paddy for the use of labourers and incidentally, to find out the most suitable variety for the tract. At Balehonnur a small area of 1.10 acres, was grown to a summer crop of paddy, but the results were discouraging. Further trials are now in progress in this field with a number of strains of paddy to find out the most suitable variety.

41. (ii) *Vegetables* :—A start was made to grow exotic and indigenous vegetables in about an acre of land. Though the venture has not commenced to pay its own way, the produce from the area is serving a very useful purpose in a tract where vegetables are practically unavailable.

42. (iii) *Fruit plants* :—A beginning has been made to revive the existing orchard area at Balehonnur station and to bring it into production. Some additions and introductions have also been effected thereto. The orange area at Chethalli which has been in a neglected condition for several years is being brought back into cultivation. A small crop produced on the trees was sold in the local market.

43. (iv) *Spices* : - 21-4 lb. cardamom and 3-1 lb. pepper were picked at Balehonnur station. One clove plant out of about 50 surviving from plantings from 1938, flowered for the first time in the year.

VI. GENERAL.

44. *Labour conditions*: :—During the year under report there was an average of 127 labourers at Balehonnur station and 40 at Chethalli station. From June, 1948, the dearness allowance of labourers was increased from one anna per day to three annas per day. Food grains

continued to be supplied at concession rates which were very much below the prevailing market rates. The health of the estate at both stations was satisfactory. Medical aid was available at the stations from part time medical officers of Mysore and Coorg administrations. Dispensaries were maintained and special efforts were made to protect against and treat for diseases like malaria. The dwelling houses are being periodically sprayed with DDT. and Paludrine is administered to all residents once a week. Two modern labour quarters were constructed during the period besides a temporary housing to accommodate new arrivals.

45. *Library* :—Books and journals of the value of Rs. 2451-3-6 were added to the library besides those received as a free supply or on an exchange basis.

46. *Co-operative Society* :—Thanks to the grant of Rs. 500 and a loan of Rs. 4,000 given by the Indian Coffee Board to the Co-operative Stores Society at Balehonnur Station, this Society was able to handle the grain and some other necessities of the labour force and the staff. With the lifting of controls on grains at the beginning of 1948, the Society is making an effort to cater to the needs of the population in materials other than grain.

47. *Audit of Accounts* :—The audit of the two stations was conducted by Messrs Fraser and Ross, Ltd., who are the auditors of the accounts of the Indian Coffee Board.

K. M. THOMAS,
Director of Research.

APPENDIX I.

INDIAN COFFEE BOARD

(RESEARCH DEPARTMENT)

Statement of Account for 1947-48

Sl. No.	Particulars	Sanctioned Budget Rs.	Revised Budget Rs.	Expenditure Rs. A. P.	Remarks
	I. NON-RECURRING. (Estate)				
1.	Buildings ...	1,66,000*	...	...	* Differentiation between the estate and Research yet to be done.
2.	Purchase of land ...	10,000	...	298 8 0	Lawyer's fees re. purchase of land includes cost of urgent equipment like D.S P. sprayers, Rubber hose, spray lances, fencing etc.
3.	Estate Equipment ...	5,000	6,000	15,666 5 1	
	Total ...	15,000	6,000	15,964 13 1	
	(2) RESEARCH				
1.	Buildings : Estate Rs. 1,66,000 Research 2,75,500 ...	4,41,500	1,00,000	1,07,407 2 3	
2.	Machinery for Power and light ...	50,000	25,000	3,988 2 6	The generator was purchased after 1st July.
3.	Laboratory Equipment & Furniture ...	75,000	10,000	1,672 9 0	
4.	Special Equipment ...	...	2,010	2,006 4 3	Monkey winch & monkey jack.
5.	Water supply, tanks & fittings ...	10,000	8,000	6,823 15 0	
6.	Station waggon and Radio ...	5,000	3,550	3,306 14 3	The expenditure relates to cost of body buildings and incidentals.
7.	Office equipment ...	...	3,000	2,037 9 0	Steel almirahs and Roneo machine.
	Total ...	5,81,500	1,51,560	1,27,242 8 3	

(Contd.)

Sl. No.	Particulars	Sanctioned Budget Rs.	Revised Budget Rs.	Expenditure Rs.	A.	P.	Remarks
	II. RECURRING EXPENDITURE (1) Estate						
1.	Pay of Staff	6,780	8,530	6,234	13	0	
2.	Provident Fund	425	...	...			
3.	War and Dearness allowance	1,503	3,293	2,861	15	0	
4.	Cultivation charges	30,000	40,000 / 22000	39,661	2	10	Rs. 22,000 payable to Mysore Government Agricultural Department.
5.	Water and light Rs. 1,500	...	...	...			Not differentiated from same item under Research and Experiments.
6.	Medical facilities (labour) Rs. 1,800	...	...	...			— do —
7.	Leave and Pension Contributions	...	390	...			
8.	Labour advance	...	10,500	10,067	3	0	
	Total ...	38,708	84,713	58,825	1	10	
	(2) RESEARCH AND EXPERIMENTS						
1.	Pay of Officers and Staff	49,140	27,580	32,365	2	9	Includes pay of catagories of employees paid from contingencies.
2.	Leave and Pension Contributions	6,000	900	539	1	9	Includes payment of Rs. 189-1-9 paid by the Secretary, Indian Coffee Board.
3.	Travelling allowances	3,500	4,500	5,282	14	9	Due to unforeseen journeys of Officers.
4.	Provident fund	3,100	600	..			
5.	War and Dearness allowances	10,800	8,410	7,701	4	0	
6.	Laboratory expenditure	6,000	6,000	4,884	3	6	Payment for materials received were made after 30th June.
7.	Field Experiments	6,000	6,000	2,800	1	6	Purchase of manures etc. was delayed.
8.	Library and publications	1,500	2,500	2,451	3	6	
9.	Postage and Stationery	1,500	2,000	2,737	14	0	
10.	Water and Light—Estate Rs. 1,500 / Research 4,500	6,000	6,000	5,477	4	0	
11.	Medical facilities—Estate Rs. 1,800 / Research 600	2,400	2,400	1,929	8	9	
12.	Taxes and Insurance	2,000	800	753	8	4	
13.	Up-keep of buildings	3,000	5,000	3,780	6	3	
14.	Donation to Co-operative Stores Society, Balehonnur	...	500	500	0	0	
15.	Purchase of food-grains	...	17,100	7,606	2	0	
	Total ...	1,00,940	90,590	78,808	11	1	

Sl. No.	Particulars		Sanctioned Budget Rs.	Revised Budget Rs.	Expenditure Rs.	Remarks
					50 0 0	
16.	Miscellaneous payments not included in the budget	...		Total	50 0 0	Payment to Co-operative Stores Society Balehonnur.
17.	Closing Balance : in cash	...			2,262 14 9	
	in Canara Banking Corporation	...			689 6 0	
	in Mysore Bank Ltd.	...			17,703 15 9	
	Permanent advance held by Mr. T. V. Pattabhiraman of Sidapur Station	...			50 0 0	
	Credited to G. F. No. 1 account with the Secretary, Indian Coffee Board, Bangalore	...			28,739 14 9	
				Total	49,446 3 3	
	NON-RECURRING			ABSTRACT		
1.	Estate	...	15,000	6,000	15,964 13 1	
2.	Research	...	5,81,500	1,51,560	1,27,242 8 3	
	Total	...	5,96,500	1,57,560	1,43,207 5 4	
	RECURRING					
1.	Estate	...	38,708	84,713	58,825 1 10	
2.	Research	...	1,00,940	90,590	78,808 11 1	
	Total	..	1,39,648	1,75,303	1,37,633 12 11	
	MISCELLANEOUS.					
1.	Payment to Co-operative Stores Society	...			50 0 0	
	Total	...			50 0 0	
	Closing balance (Bank and Cash)	...			49,446 3 3	
	GRAND TOTAL	...	7,36,148	3,32,863	3,30,337 5 6	

(Contd.)

Sl. No	Particulars	Anticipated Rs.	Revised Rs.	Actuals Rs.	A.	P.	Remarks
1.	Receipts by sale of coffee & cardamoms ...	26,400	44,500	28,739	14	9	Amount credited directly to the account of Secretary, I.C.B.
2.	Realizations by sale of food grains ...	...	6,200	3,679	1	3	
3.	Recovery of Provident Fund ...	...	426	425	15	0	
4.	Recovery of labour advance ...	...	5,120	5,127	11	3	
	Total ...	26,400	56,246	37,972	10	3	
	OTHER MISCELLANEOUS ITEMS NOT INCLUDED IN THE BUDGET						
1.	Receipts from other produce ...	...	...	2,079	10	6	
2.	Miscellaneous Receipts ...	...	...	2	0	0	
3.	Recovery of Advances from Contractors ...	...	...	40,624	0	9	
4.	Advance recovered from the Co-operative Stores Society, Balehonnur ...	...	...	1,000	0	0	
	Total ...	...	...	43,705	11	3	
	BY CASH						
1.	From the Secretary, Indian coffee Board (including bills paid) ...	...	...	2,33,601	6	5	
2.	From Mr. G.M. Manjanathayya—Visiting Agent Woddermotte ...	...	...	12,354	2	7	
3.	By bills cashed at the Koppa Treasury ...	...	...	82	8	0	
4.	Cash balance brought forward ...	...	...	2,620	15	0	
	TOTAL ...	..	...	2,48,659	0	0	
	GRAND TOTAL ...	...	...	3,30,337	5	6	

APPENDIX II A.

Rainfall Record of the Coffee Research Station, Balehonnur (Mysore)

Month	Rainfall recorded in inches during										Average for 10 years	Rainfall recorded during 1947-48 in inches
	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47		
July ...	46.53	25.60	37.73	39.94	32.16	45.95	47.43	41.61	37.52	35.80	39.03	35.97
August ...	11.84	15.79	18.72	33.85	21.31	20.14	9.89	10.79	10.72	47.93	20.10	30.34
September ...	6.10	6.58	3.59	3.07	5.34	5.39	16.11	2.92	9.11	11.51	7.00	9.80
October ...	3.40	2.32	13.09	7.71	8.76	7.18	15.29	12.42	4.25	3.56	8.40	2.62
November ...	0.46	0.80	3.83	7.05	0.21	0.21	2.53	2.71	1.08	7.04	2.59	1.14
December ...	2.52	0.04	0.00	0.70	2.22	1.37	0.01	0.07	0.00	1.09	0.80	0.91
January ...	...	0.10	...	0.05	...	0.47	0.03	...	...	0.36	0.10	0.26
February ...	...	...	0.08	...	...	...	1.00	...	0.03	...	0.11	...
March ...	1.73	0.12	...	1.05	...	0.15	0.60	...	0.52	1.86	0.60	0.19
April ...	6.12	2.56	2.84	1.66	4.63	2.06	1.04	3.92	9.05	1.56	3.54	9.94
May ...	1.24	0.67	6.77	4.46	5.49	11.76	5.78	2.73	4.28	5.21	4.84	2.41
June ...	27.19	8.35	22.91	24.34	19.52	13.47	7.81	8.65	23.53	9.90	16.57	15.67
Total ...	113.13	62.93	109.56	123.88	99.64	108.15	107.52	85.82	100.09	125.82	103.54	109.25

APPENDIX II. B.

Rainfall Record of the Coffee Research Sub-Station, Chethalli (Coorg)

Month	Rainfall recorded in inches during										Average for 10 years	Rainfall recorded during 1947-48 in inches
	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47		
July ...	26.96	15.83	21.93	23.50	16.06	26.93	31.45	36.00	30.84	10.71	24.02	23.35
August ...	4.23	8.84	14.26	18.20	12.91	12.29	4.69	4.93	7.64	24.91	11.29	18.85
September ...	3.51	6.55	2.94	2.96	6.36	3.91	8.91	1.83	3.50	8.25	4.87	8.64
October ...	6.78	9.93	10.58	7.10	4.22	5.84	11.50	6.04	4.63	3.93	7.06	9.98
November ...	1.64	1.33	5.06	8.39	1.42	0.42	6.55	4.00	2.09	6.16	3.71	0.13
December ...	0.50	0.24	0.00	0.67	1.88	1.01	0.00	0.51	0.00	2.31	0.71	1.05
January ...	0.00	0.20	0.02	0.00	0.00	1.24	0.00	0.00	0.00	0.00	0.15	0.50
February ...	0.00	0.00	0.00	0.00	0.00	0.16	1.05	0.00	0.00	0.72	0.19	0.40
March ...	1.81	0.03	0.00	4.61	1.78	0.42	0.33	0.00	2.02	0.00	1.10	0.00
April ...	4.58	4.41	6.55	3.70	3.02	2.16	0.87	7.38	8.32	1.53	4.25	4.75
May ...	1.76	3.53	4.90	5.10	8.55	11.78	1.40	2.29	1.35	4.69	4.53	3.80
June ...	15.89	7.06	22.02	19.24	14.77	9.10	7.02	10.35	13.59	7.31	12.64	10.53
Total ...	67.66	57.95	88.26	93.47	70.97	75.26	73.77	73.33	73.98	70.52	74.52	81.98

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